

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of: :  
: Confirmation No.: 1242  
Robert Sheffield et al. :  
: Group Art Unit: 1753  
Appln. No.: 10/667,491 :  
: Examiner: Luan V. Van  
Filed: September 23, 2003 :  
:  
For: REDUCED CIRCUIT TRACE :  
ROUGHNESS FOR IMPROVED SIGNAL :  
PERFORMANCE :

Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**RESPONSE TO FINAL OFFICE ACTION DATED MARCH 22, 2011**

Sir:

In response to the Final Office Action dated March 22, 2011 ("Office Action"), please consider the following remarks regarding the above-identified patent application.

- Listing of the Claims begins on Page 2.
- Remarks begin on Page 6.

**IN THE CLAIMS:**

Claim 1 has been amended.

New claims 23-24 have been added.

A listing of the status of all claims 1-22 in the present patent application is provided below.

1 (**Currently Amended**). A method for improving performance of a signal transmitted via a conductive circuit trace of a circuit board, the method comprising the step of:

providing a first circuit board layer of ~~the~~ a circuit board having ~~the~~ a conductive circuit trace on a surface of the first circuit board layer thereof;

laminating the first circuit board layer with a second circuit board layer; and

reducing a surface roughness of at least one surface of the conductive circuit trace on the surface of the first circuit board layer using a smoothing technique prior to lamination of the first circuit board layer with the second circuit board layer so as to improve performance of a signal transmitted via the conductive circuit trace, wherein the surface roughness of the at least one surface is reduced to no more than 20 microinches root-mean-squared (RMS), wherein the smoothing technique comprises at least one of a lateral smoothing

technique and a transverse smoothing technique, the lateral smoothing technique reducing surface roughness in a direction along the conductive circuit trace and the transverse smoothing technique reducing surface roughness in a direction across the conductive circuit trace.

2 (Previously Presented). The method as in Claim 1, wherein the step of reducing the surface roughness includes one of a group consisting of: electropolishing the at least one surface; chemical polishing the at least one surface; electrochemical polishing the at least one surface; chemical-mechanical polishing the at least one surface; mechanical polishing the at least one surface; electroplating the at least one surface; and vacuum depositing conductive material on the at least one surface.

3 (Cancelled).

4 (Original). The method as in Claim 1, wherein the surface roughness of the at least one surface is reduced to no more than 10 microinches root-mean-squared (RMS).

5 (Original). The method as in Claim 1, wherein the surface

roughness of the at least one surface is reduced to no more than 5 microinches root-mean-squared (RMS).

6 (Original). The method as in Claim 1, wherein the at least one surface of the conductive circuit trace includes one of a group consisting of: a surface parallel and distal to a surface of the circuit board; a surface parallel and proximal to the surface of the circuit board; and a surface perpendicular to the surface of the circuit board.

7-18 (Cancelled).

19 (Previously Presented). The method as in Claim 1, wherein the conductive circuit trace is formed on the surface of the circuit board layer.

20 (Previously Presented). The method as in Claim 1, wherein the conductive circuit trace is affixed to the surface of the circuit board layer.

21 (Previously Presented). The method as in Claim 1, wherein the smoothing technique is a lateral smoothing technique.

22 (Previously Presented). The method as in Claim 1, wherein the smoothing technique is a transverse smoothing technique.

23 (**New**). The method as in Claim 1, wherein the step of reducing the surface roughness comprises electroplating the at least one surface.

24 (**New**). The method as in Claim 1, wherein the step of reducing the surface roughness comprises vacuum depositing conductive material on the at least one surface.

REMARKS

The Office Action of March 22, 2011 has been received and carefully considered. New claims 23-24 have been added. No new matter has been added. Support for these amendments may be found in at least page 12, line 22 - page 14, line 14 of the Specification. Claims 3 and 7-18 were previously cancelled. Thus, claims 1-2, 4-6, and 19-24 are currently pending. Reconsideration of the current rejections in the present application is respectfully requested based on the following remarks.<sup>1</sup>

I. THE OBVIOUSNESS REJECTION OF CLAIMS 1, 2, 4-6, 19, and 20

On page 2 of the Office Action, claims 1, 2, 4-6, 19, and 20 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 4,959,507 to Tanaka et al. ("Tanaka") in view of U.S. Publication No. 2002/0155021 to Nagai et al. ("Nagai"). However, Applicants respectfully traverse this rejection.

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<sup>1</sup> As Applicants' remarks with respect to the Examiner's rejections are sufficient to overcome these rejections, Applicants' silence as to assertions made by the Examiner in the Office Action or certain requirements that may be applicable to such rejections (e.g., assertions regarding dependent claims, whether a reference constitutes prior art, whether references are legally combinable for obviousness purposes) is not a concession by Applicants that such assertions are accurate or such requirements have been met, and Applicants reserve the right to analyze and dispute such in the future.

Under 35 U.S.C. § 103, the Patent Office bears the burden of establishing a prima facie case of obviousness. In re Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988). There are four separate factual inquiries to consider in making an obviousness determination: (1) the scope and content of the prior art; (2) the level of ordinary skill in the field of the invention; (3) the differences between the claimed invention and the prior art; and (4) the existence of any objective evidence, or "secondary considerations," of non-obviousness. Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966); see also KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727 (2007). An "expansive and flexible approach" should be applied when determining obviousness based on a combination of prior art references. KSR, 127 S. Ct. at 1739. However, a claimed invention combining multiple known elements is not rendered obvious simply because each element was known independently in the prior art. Id. at 1741. Rather, there must still be some "reason that would have prompted" a person of ordinary skill in the art to combine the elements in the specific way that he or she did. Id.; In re Icon Health & Fitness, Inc., 496 F.3d 1374, 1380 (Fed. Cir. 2007). Also, modification of a prior art reference may be obvious only if there exists a reason that would have prompted a person of ordinary skill to make the change. KSR, 127 S. Ct. at 1740-41.

Claim 1 expressly recites a "method for improving performance of a signal transmitted via a conductive circuit trace of a circuit board, the method comprising the step of: providing a first circuit board layer of the circuit board having a conductive circuit trace on a surface of the first circuit board layer; laminating the first circuit board layer with a second circuit board layer; and reducing a surface roughness of at least one surface of the conductive circuit trace on the surface of the first circuit board layer using a smoothing technique prior to lamination of the first circuit board layer with the second circuit board layer so as to improve performance of a signal transmitted via the conductive circuit trace, wherein the surface roughness of the at least one surface is reduced to no more than 20 microinches root-mean-squared (RMS), wherein the smoothing technique comprises at least one of a lateral smoothing technique and a transverse smoothing technique, the lateral smoothing technique reducing surface roughness in a direction along the conductive circuit trace and the transverse smoothing technique reducing surface roughness in a direction across the conductive circuit trace" (emphasis added). None of the asserted references, alone or in combination, teach at least these limitations.

Tanaka is directed to a bonded ceramic-metal composite substrate, with a focus on production of such substrates. See, e.g., Tanaka, Title; Abstract; col. 1, lines 43-51. Nagai is directed to a copper-allow foil to be used for a laminate sheet, with a focus on bonding the copper-alloy to the laminate sheet. See, e.g., Nagai, Title; Abstract; paragraph [0002]. Although Tanaka and Nagai both teach reduced surface roughness, nothing in either Tanaka or Nagai teaches at least "laminating the first circuit board layer with a second circuit board layer," "reducing a surface roughness of at least one surface of the conductive circuit trace on the surface of the first circuit board layer using a smoothing technique prior to lamination of the first circuit board layer with the second circuit board layer," and "wherein the smoothing technique comprises at least one of a lateral smoothing technique and a transverse smoothing technique, the lateral smoothing technique reducing surface roughness in a direction along the conductive circuit trace and the transverse smoothing technique reducing surface roughness in a direction across the conductive circuit trace," as expressly claimed.

These claim limitations highlight new and unexpected results not taught or even contemplated by Tanaka or Nagai. For example, by reducing a surface roughness of the first

circuit board layer prior to lamination of a second circuit board layer, improved performance of a signal transmitted via the conductive circuit trace may be obtained. To seek to polish an interior layer of a multi-layer circuit board may typically be difficult and costly. See, e.g., Specification, pages 12-13. In addition, by using the claimed smoothing techniques, the improvement in the transmitted signal may, in certain instances, result in up to 20% improvement for lateral smoothing while signal improvements resulting from transverse polishing may improve 50% or more. See, e.g., Specification, pages 10-11. At most, Tanaka and Nagai teach nothing more than traditional techniques and focus on their respective purposes of substrate and copper-alloy bonding. The Office blatantly ignores these advantages, which were clearly outlined by Applicants in the previous Response.

Instead, on page 5 of the Office Action, the Office bases his argument on the statement that "polishing laterally or transversely does not necessarily mean polishing in a linear fashion but simply suggests a direction of polishing." However, Applicants respectfully disagree. The claim recites "the lateral smoothing technique reducing surface roughness in a direction along the conductive circuit trace" and "the transverse smoothing technique reducing surface roughness in a

direction across the conductive circuit trace" (emphasis added).

In other words, the claimed smoothing techniques provide improved signal transmission based on the specific direction of the polishing. Thus, the Office's allegation that "even circular patterns, spiral patterns, etc., one can polish using these patterns in a lateral or transverse direction" is clearly misguided.

Even assuming, for the sake of argument, that the Office's assertions are convincing, which Applicants do not so concede, there is nothing in Tanaka or Nagai that even teaches any type lateral, transverse, circular, spiral, or the like. Accordingly, to argue that non-linear forms of polishing may read on the claim limitations without providing any evidence that Tanaka or Nagai even teach these non-linear forms is also improper.

In view of the foregoing, the Office has failed to establish a proper prima facie case of obviousness for at least claim 1.

Regarding claims 2, 4-6, and 19-22, these claims are dependent upon independent claim 1. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071 (Fed. Cir. 1988). Thus, since independent claim 1 should be allowable as

discussed above, claims 2, 4-6, and 19-20 should also be allowable at least by virtue of their dependency on independent claim 1.

In view of the foregoing, Applicants respectfully request that the aforementioned rejection of claims 1-2, 4-6, and 19-22 be withdrawn.

New claim 23 recites that "the step of reducing the surface roughness comprises electroplating the at least one surface" and new claim 24 recites that "the step of reducing the surface roughness comprises vacuum depositing conductive material on the at least one surface." None of the cited references teach the use of these techniques.

In view of the foregoing, Applicants respectfully submit that new claims 23-34 are also allowable over Tanaka and Nagai.

II. CONCLUSION

In view of the foregoing, Applicants respectfully submit that the present application is in condition for allowance, and an early indication of the same is courteously solicited. The Examiner is respectfully requested to contact the undersigned by telephone at the below listed telephone number, in order to expedite resolution of any issues and to expedite passage of the present application to issue, if any comments, questions, or suggestions arise in connection with the present application.

To the extent necessary, a petition for an extension of time under 37 CFR § 1.136 is hereby made.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-0206, and please credit any excess fees to the same deposit account.

Respectfully submitted,

Hunton & Williams LLP

Date: 5/23/11

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